

Mirror56 tool, QE map, QE

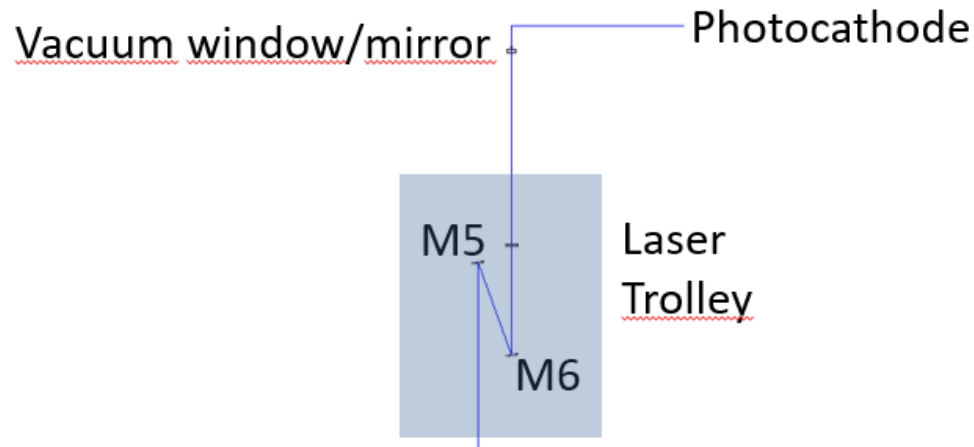
Teaching for the PITZ shift crew

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The Laser Trolley

Laser beam distribution and characterization in the accelerator tunnel

- Two mirrors M5 and M6
 - 4 degrees of freedom → able to choose beam positions on vacuum mirror and photocathode independently



- Mirrors 5 and 6

laserbeamline_main.xml PITZ.LBL/

laser beamline

vacuum

cathode

BOUCAMERA VC2

switch on camera off -3.3

power lead at LOW Scr1

mirror out

PUSH IN + VC2 on

strong signal

quartz: weak signal

mirror: strong signal

OD signals (ADC)

quadrant diode

close open

shutter closed

energy meter

PD display

diameter readback: -1.179 mm

APERTURE

photodiode

spectrum

push in

pull out

diode out

MIRROR M3

MIRROR M4

MIRROR M5

MIRROR M6

PMT pulse counter

tunnel shaft

forbidden, no IL

disabled

close

10 pulse(s)

27.0 % attenuator

laser hut

laser

MICOS controller

PITZ Control

gun overview overview booster overview

adc modules

beam inhibit system

why FSM why

DAQ

diagnostic

interlock

laserbeamline

laser pharos

magnets

RF1 -> booster RF2 -> gun RF5 -> TDS

radiation protection

vacuum

water / temperature

other alarms

IBPC operating time: 21056 75803757

plasma cells climate overview

logbook PITZ gun conditioning info

timing settings to logbook

tools watchdog system

Save&Restore - Tool Snapshot to logbook PITZ

M5.X M5.Y

Status: Status:

Upper limit: 10.564 Upper limit: 0.000

Actual position: -1.900 Actual position: -10.400

Lower limit: -3.126 Lower limit: -13.698

Move absolute: -1.90 set to Move absolute: -12.00 set to

Move relative: 3.10 change by Move relative: -0.15 change by

Motion status: MOVING Motion status: MOVING

Light sensor status: Light sensor status:

Expert Expert

M6.X M6.Y

Status: Status:

Upper limit: 0.000 Upper limit: 0.000

Actual position: 0.000 Actual position: 0.000

Lower limit: -12.567 Lower limit: -13.285

Move absolute: 0.00 set to Move absolute: 0.13 set to

Move relative: 1.00 change by Move relative: 0.02 change by

Motion status: MOVING Motion status: MOVING

Light sensor status: Light sensor status:

Expert Expert

Mirror56 – Standard Matlab Script

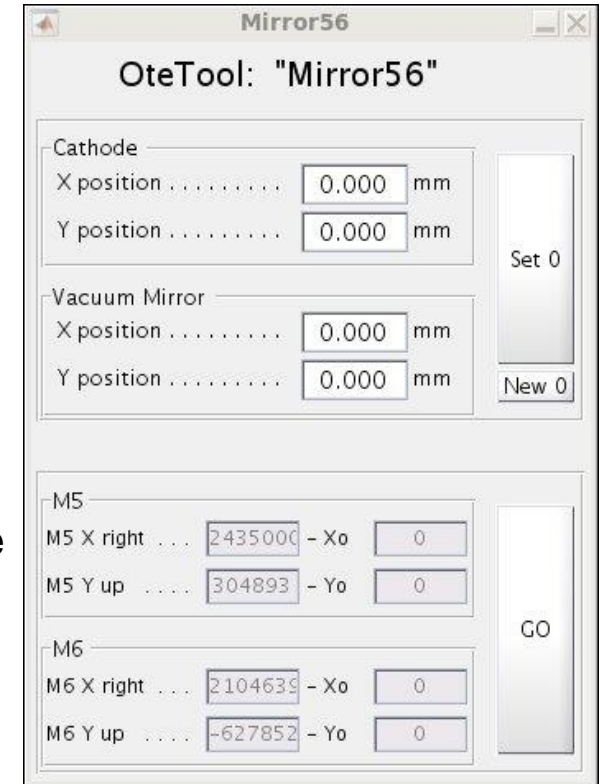
Script does all the linear algebra calculations for positioning the laser beam

- Before using the tool: print backup of positions of mirrors 5 and 6 to logbook
 - Makes it possible to go back to starting position in case mirrors stopping during movement and losing absolute positioning

- Script Mirror56
 - Type new relative position
 - Click “GO”
 - Wait for execution – check in Matlab window

- Set 0
 - All relative positions go back to 0, but no mirror movements yet

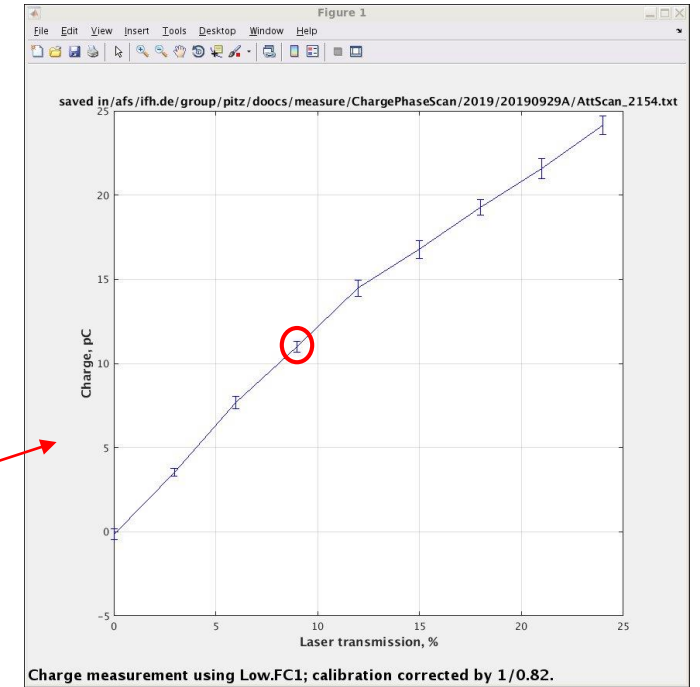
- New 0
 - Current mirror positions are set as new relative 0 (warning window will open first)



QE Map

Preparations

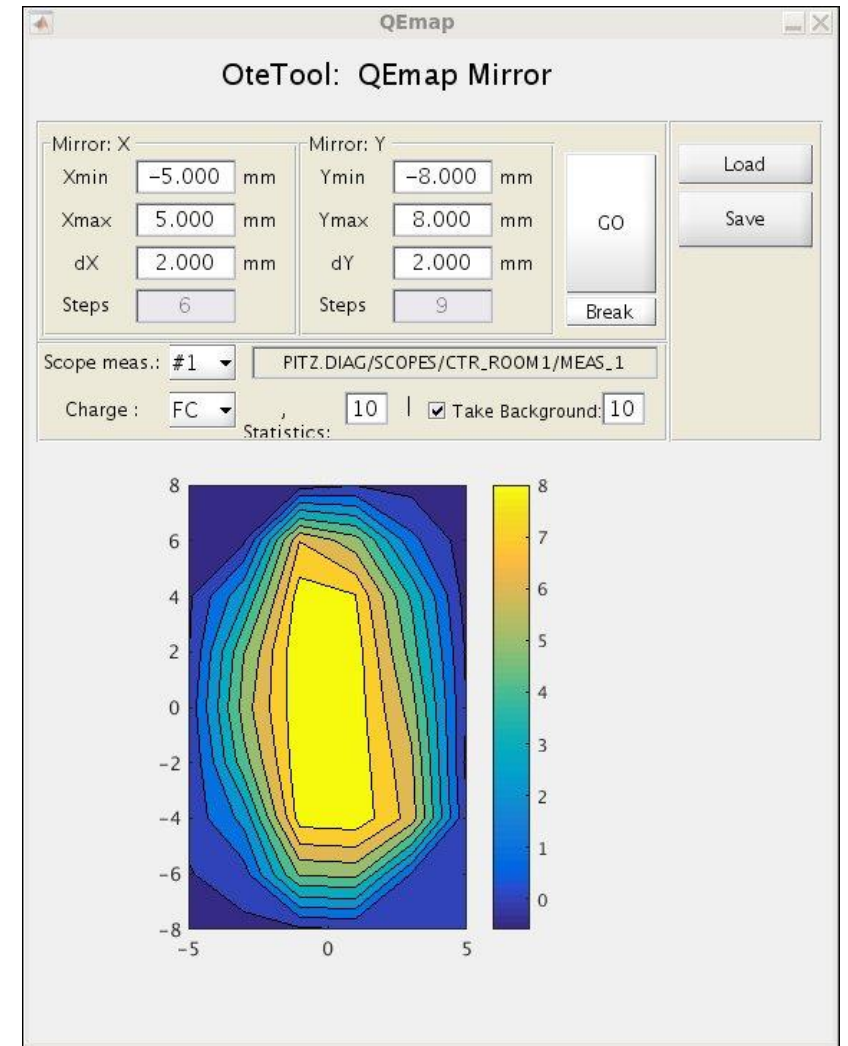
- Set gun to nominal gradient: power 6.5 MW in the gun @ MMMG phase
- Choose a BSA of 0.25mm
- Choose solenoid current, so that the beam is focused on the screen of measurement unit (Low.Scr1 for Low.FC1 or Low.Scr2 for Low.FC2), e.g. 450A for Low.Scr1
- Insert Faraday cup
- Run attenuator scan script: tools → measureQE
- Choose an attenuator setting in the linear part of the scan, at about the upper 3/4 of the linear part where the bunch charge is about 10 to 15 pC



QE Map

Measurement: vacuum mirror

- Find the movement range for the QE map (vacuum mirror):
 - Print positions of mirror5 and mirror6 to logbook
 - Run mirror56 script
 - Move beam on vacuum mirror and observe the charge from the Faraday cup → find the left, right, top, bottom edge of the vacuum mirror
 - Move beam back to 0,0 position
- Run the script QEmap
 - Choose mirror, choose scope
 - Scan range as found above
 - Choose step size: $dX = 0.5$ mm, $dY = 1.0$ mm
 - Charge measurement: Faraday cup
 - Define scope measurement channel (#1 or #2)
 - Statistics: 10
 - Take Background: 100 (check box)
- Save results and print to logbook
- Choose new middle position on vacuum mirror; go there and record in logbook

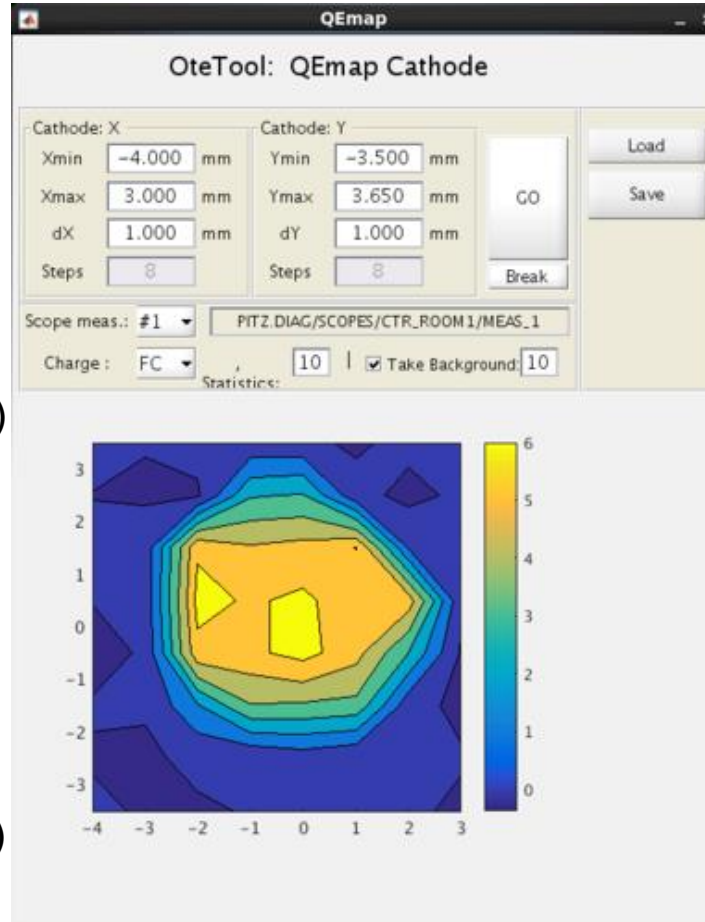


QE Map

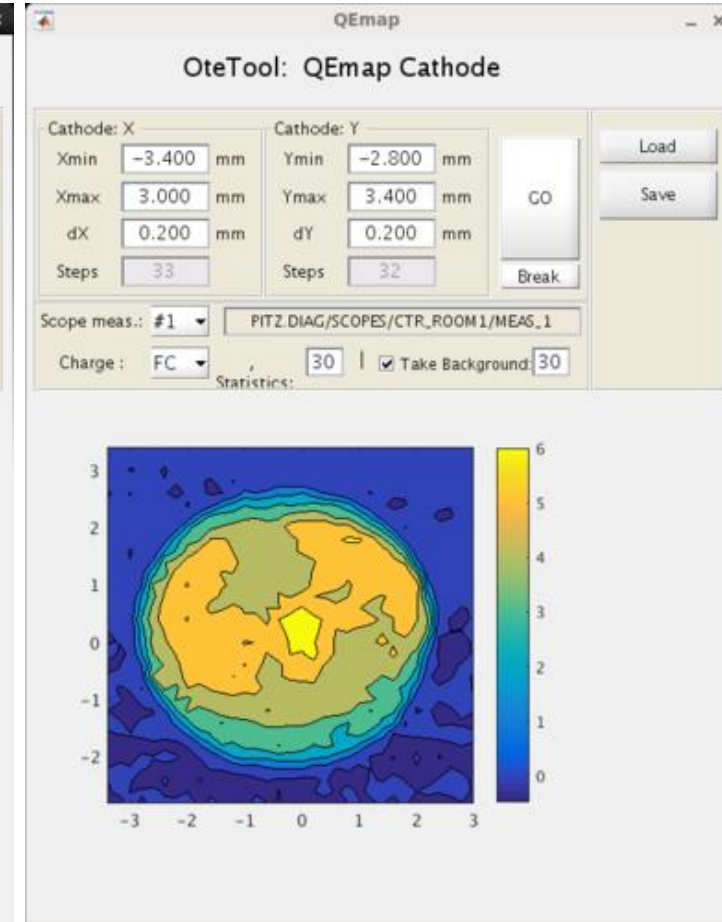
Measurement: QE map

- Find the movement range for the QE map (cathode): same as for vacuum mirror
- Run the tool QEmap and do a coarse scan
 - Choose cathode and scope
 - Scan range as found above
 - Choose step size: $dX = dY = 1.0$ mm
 - Charge measurement: Faraday cup
 - Statistics: 10; Take Background: 100 (check box)
- Save results and print to logbook
- If the range is well defined (cathode fully visible and fills most of the area) do a fine scan
 - $dX = dY = 0.2$ mm
 - Statistics: 30; Take Background: 100 (check box)
- Save results and print to logbook

Rough QE map



Fine QE map

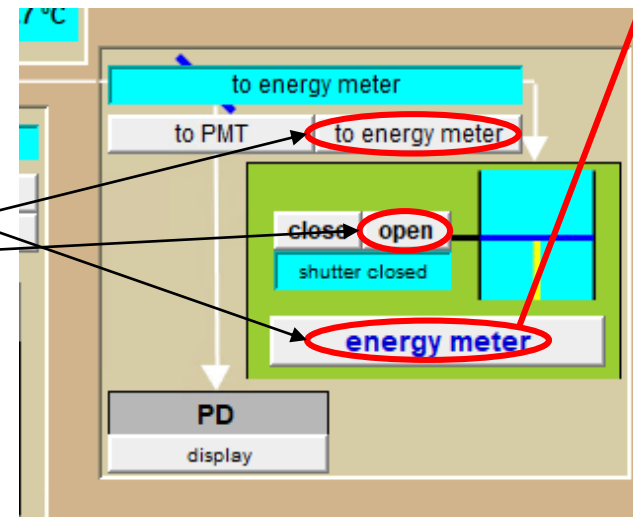


QE Measurement

Preparations

- Set laser BSA size to 1.0 mm or different, if specified
- Set gun to nominal gradient: power 6.5 MW in the gun @ MMMG phase
- Measure momentum after gun with LEDA
- Put the gun phase to MMMG
- Choose solenoid current, so that the beam is focused on the screen of measurement unit (Low.Scr1 for Low.FC1 or Low.Scr2 for Low.FC2), e.g. 450A for Low.Scr1
- Insert Faraday cup
- Check that laser beam is on energy meter
 - Start energy meter GUI from laserbeamline GUI
 - Click ,measure‘
 - Open energy meter shutter; click , to energy meter‘
 - Open shutter
 - If necessary, adjust energy range
- → Frequency 10 Hz, Energy >0 and updating

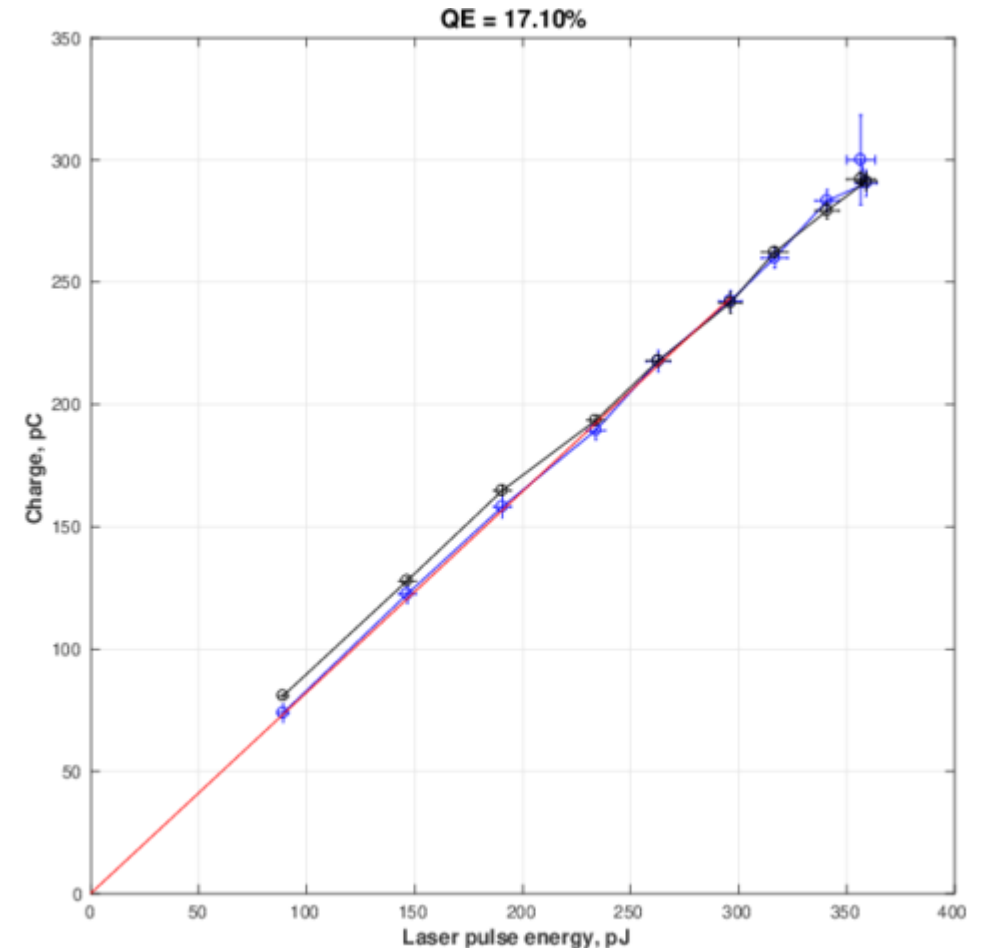
Head type	~CP J	TUNNEL		set filename	help
stop	measure	dialog	average	write to file	enable
200 nJ	20.0 nJ	2.00 nJ	200 pJ	reconnect	disable
Measurement		measuring		Settings	
Frequency		Energy	Power	Range	Time [sec]
10.00000 Hz	Single	1.66300E3 pJ	0.00000 mW	2.00 nJ	20
	Average	1.34745E3 pJ			0
Connection to device					
Sent string		Received string			
\$SE		* 1.000E1			
Errors					
Error code		Error string			
0		no error			
		measurement allowed			



QE Measurement

Measurement

- Run MeasureQE script: tools → measureQE
- Print measurement output window to PITZ logbook
- Write to logbook entry
 - BSA size:
 - Gun SP and power:
 - Phase SP: x (MMMG +/- z)
 - Solenoid-Current:
 - Laser pulse shape/-length:
- **Wrap up**
- Remove Faraday Cup (FC) from beam tube
- Close energy meter shutter
- Option: close laser shutter, adjust number of pulses and LT



Data saved to